

COMMONALITIES OF EQUITY MARKET FUNDAMENTALS AND  
RETURN COMOVEMENTS: AN EMERGING AND FRONTIER MARKET PERSPECTIVE<sup>1</sup>

COMUNALIDADES DOS FUNDAMENTOS DE MERCADO DE CAPITAIS E CO-MOVIMENTOS  
DE RETORNO: UMA PERSPECTIVA DE MERCADOS EMERGENTES E DE FRONTEIRAS

**Mobeen Ur Rehman<sup>2</sup>**

Shaheed Zulfikar Ali Bhutto Institute of Science and Technology, Islamabad.

[Mobeen.rehman@szabist-isb.edu.pk](mailto:Mobeen.rehman@szabist-isb.edu.pk)

<https://orcid.org/0000-0002-8889-9051>

**Syed Muhammad Amir Shah**

Allama Iqbal Open University, Islamabad, Pakistan

[Dramirshah@aiou.edu.pk](mailto:Dramirshah@aiou.edu.pk)

**Javed Ghulam Hussain**

Birmingham City University, UK

[Javed.hussain@bcu.ac.uk](mailto:Javed.hussain@bcu.ac.uk)

**ABSTRACT**

**Objective:** To explore the bilateral relationship of trading volume, market size differential, foreign portfolio equity holdings and interest rates with international stock market co-movements.

**Background:** Stock returns are based on the market fundamentals of companies according to traditional literature on finance however international equity markets share interconnectedness with each other. Return co-movements between any two markets therefore, are based not only on any single market fundamentals but on the bilateral relationship among stock market's fundamentals.

**Method:** We select ten Asian emerging and frontier equity markets from January 2000 to December 2014 using panel co-integration techniques. Pakistani equity market is selected as a home country with which bilateral equity co-movement of other markets is analyzed.

**Results:** Long run relationship between bilateral equity market co-movement and its determinants are reported. In short-run only bilateral trading volume and exchange rate differential between the two countries have significant impact on bilateral equity co-movement.

**Contributions:** Our study has implication for policy makers, institutional and individual investors. Understanding these relationships between bilateral equity market co-movement and its determinants can help investors to gain diversification benefits keeping in view the associated bilateral co-movement, its determinants and their underlying relationship.

**Keywords:** Return co-movements; stock market fundamentals; emerging and frontier markets.

<sup>1</sup> Paper received on: 09/11/2017. Reviewed by peers on: 12/05/2017. Reformulated on: 04/12/2018. Recommended for publication in: 04/12/2018. Published: 12/26/2018 by Luiz Felipe de Araújo Pontes Girão (Editor in chief). Published: 26/12/2018. Organisation responsible for the journal: UFPB.

<sup>2</sup> Adress: Kehkashan, SZABIST 90• Scheme 5, 75600, Karachi, Pakistan.

## 1. INTRODUCTION

One of the main problems faced by international investors is the allocation of their wealth among the options of assets available in the global financial market. The formulation of a well-diversified portfolio not only depends on bilateral equity co-movement and financial integration among the associated markets but also on the complex system of interlinked processes and factors, such as increasing international trade, business cycle synchronization, low and convergent inflation and interest rates etc. (Aggarwal, Lucey and Muckley, 2010). These interlinked processes can not only determine the intensity and dynamics of equity market co-movements but also affect diversification benefits available to investors. The current paper focuses on the formulation of effective diversified portfolio given an investor's interest and ability for risk by selecting among international equity markets.

Since the early proponents of portfolio diversification (Markowitz, 1952; Grubel, 1968; Lintner, 1965), decrease in diversification benefits are found to be consistent with increasing equity market integration (see Erb, Harvey and Viskanta, 1996; Kearney and Poti, 2006). Aggarwal et al. (2010) argue that while integration is driven by various markets forces, it is found to be constrained by regulatory barriers. Therefore, the emerging markets have attracted high attention in the literature since they are relatively isolated from the shocks transmitted from developed markets (Choe et al. 2012; Kenourgios and Padhi, 2012).

This isolation of emerging equity markets from the developed markets offer significant risk reduction opportunities for international investors. Furthermore, emerging markets are more arranged in segments relative to the developed markets because of commonality in their size, institutional structure and geographical location (Bekaert et al., 2014; Carrieri et al., 2007; Christoffersen et al., 2012). Walti (2011) in his study identified several financial integration and macro-economic variables to explain equity market co-movement. He also identified determinants of time varying correlation among the participating countries. With an increasing level of financial and market integration among all forms of efficient markets, i.e., developed, frontier and emerging, diversification benefits are hard to achieve with any single form.

This paper is motivated by two streams in the literature. First, is the studies analyzing integration across emerging financial markets in the context of construction of the effective diversified portfolios (e.g. Erb, Harvey and Viskanta, 1996; Forbes and Rigobon, 2002; Hardouvelis, Malliaropulos and Priestley, 2006; Kearney and Poti, 2006). Second is the stream of thought-provoking studies on the determinants of the global market interconnectedness (Bracker et al., 1999).

These literature strands underpin the theoretical base of our research and provide rational for the research hypotheses tested in this paper. This paper contributes to the existing literature by providing novel evidence on the commonality and stability of such determinants between the pair of emerging-frontier efficient market combination.

Although return co-movements between international markets help investors in effectively diversifying their portfolios, merely relying on such correlation values can become insufficient. There can be a lot of important underlying variables that can influence and trigger such bilateral stock market co-movements. Therefore, aim of our study is to explain determinants of bilateral stock market co-movement between an emerging-frontier market pairs.

The structure of this paper is as follows. Section 2 entails review of past relevant literature on the topic. Section 3 defines the methodology used. Section 4 presents analysis of data. Finally, section 5 provides conclusion of our study with policy implications in the lights of empirical findings.

## 2. LITERATURE REVIEW

Existing literature presents mixed results regarding the level of integration across international financial markets (for example see Choe et al. 2012; Kenourgios and Padhi, 2012; Lin et al, 1994; Rehman and Shah, 2016). In the context of this paper, integration manifests itself in absence of arbitrage opportunities among markets situated in different geographical regions (Baele et. al, 2004). Therefore, intensification of both, i.e. intra and inter- regional interconnectedness of the markets will indicate integration.

The analysis of return co-movements patterns across financial markets has a long history of research. While the pioneer studies in this area considered correlation coefficient between markets to be static (Panton, Lessig, and Joy, 1976; Watson, 1980), later researches confirmed that stock market interconnectedness is dynamic process (Longin and Solnik, 1995; Bekaert and Harvey, 1995), and furthermore increasing with the time (e.g. Campbell and Hamao, 1992; Shahzad et al. 2016; Narayan and Rehman, 2017).

Co-movement pattern among international stock markets has been an important topic in the field of finance due to its practical implications in asset allocation and risk management. The initial work of Grubel (1968) in the field of international diversification is followed by the contribution of many past researchers (see Zhang and Li, 2014; Gupta and Guidi, 2012; Mukherjee and Bose, 2008; Wong et al., 2004; Huang et al., 2000; Rehman and Shah, 2016).

Many of these studies concluded the presence of an increasing co-movement pattern between developed and emerging equity markets since mid-1990s. According to Lin et al. (1994), unlike traditional correlation coefficient analysis to measure co-movement, many new techniques like rolling window correlation, wavelet analysis and non-overlapping sample periods can provide better estimation results.

Dependence structure of international equity markets has gained a lot of attention among various theorists, research community and practitioners especially after several global financial crises. These crises include the crash of 1987, Tequila crisis of Mexico in 1994, Asian flu of East Asia in 1997, Russian virus of 1998, currency crisis of Brazil in 1999 and the global financial crisis of 2008-09.

The global financial crisis of 2008-09 was the worst of its kind after the great depression of 1930 (Wang, 2013; Rehman 2016). This crisis followed by the demise of Lehman Brothers affected not only developed but also the emerging markets of the world. It also led many major collapses like Eurozone crisis (2009-12), London movement (2011-12) and the public reactions in Greece, Italy, Turkey and Egypt (2010-11).

Because of all the above-mentioned events, significant attention was observed towards the fundamental of stock market co-movement to determine the simultaneous deterioration causes in the wealth of larger group of countries (Uygur and Tas, 2014). Many questions were also raised regarding the determinants of stock market co-movements, especially about the stability and commonality of these underlying determinants.

There are many factors that play important role in the co-integration among international stock markets. Such factors include strong economic ties and policy coordination, market deregulation and liberalization, and financial crises and contagion effects (Jeon & Chiang, 1991, Rehman et al. 2018). Therefore, co-movement between two specific stock markets may have some strong underlying reasons that may not last for long time periods.

Moreover, just the presence of co-movements does not guarantee long term dependence; thus, the reasons for such co-movements need to be explored. In a study by Chi et al. (2006) on the co-movement of Taiwan stock market with international equity markets, results were positive for US, Japanese and Hong Kong equity markets. These co-movements indicated short term relationships of Taiwanese equity market with US market but diminishing effect with Hong Kong stock market.

Previous literature highlights the factors behind international co-movement of equity markets. Such factors include trade intensity by Chinn and Forbes (2004) and Sohail et al. (2017), business cycle synchronization by Walti (2011), financial development by Dellas and Hess (2005) and geographical variables by Flavin et al. (2002). Although the factors discussed above have some explanatory power, results were influenced by the heterogeneity issue due to included country sample variation e.g. emerging vs. developed markets, applied econometric approaches and the measurement of explanatory variables (Beine and Candelon, 2011).

According to Erbaykal and Karaca (2008), capital inflow in developing countries is one of the main reasons for an increase in this financial integration. Among other factors, one is the removal of legal barriers among participating countries that result in the reduction of overall cost with increased market efficiency. Another reason can be attributed to the reduced efficiency of the instruments used in portfolio diversification.

Results of the study conducted by Beine and Candelon (2007) indicated that co-movement of stocks among included markets show positive results mainly attributable to trade liberalization; that accounted for major explanation of equity co-movements. According to Kallberg and Pasquariello (2008), excess co-movements among security prices are co-variation between them, more than what can be explained by fundamental factors. According to Arouri et al. (2012), co-movements are attributed to various economic events, regime shifts and financial crises period.

Excess co-movements has various factors that, according to King and Wadhvani (1994), are pure transmission of information; for Calvo et al. (1994) a financial constraint; for Allen and Gale (2004) the fragility of financial markets; for Kyle and Xiong (2001) the wealth effect; and for Barberis et al. (2005), investor's trading patterns.

Correlation between different stock markets is like a network depicted by time varying synchronization among them. On the top, developed markets demonstrate more integration as compared to the emerging markets. However, all markets behave in a synchronous manner after the experience of fluctuations, which according to Liu and Chi (2012) is more obvious in frontier markets.

The correlation among stocks is a proxy for shocks to aggregate stocks. This is because risk price of correlation among stocks shows that investors are actually concerned about the economic uncertainties. On the other hand, same correlation risk conveys the implications of diversification, thus implying that the investor also pays attention to stock co-movements.

Thus, by carefully checking the correlation risk and the price implications generated by it, distinctive factors between pure portfolio-based investors and economic based investors can be explored (Sun et al., 2012). High correlation among equity stocks has two dimensions. One is the large exposure of aggregate risk to portfolio implying low benefits of diversification, whereas, on the other hand, if correlation is high among the portfolio stocks, then investor demands extra returns on securities with low pay off. This makes risk price of the correlation negative for portfolio stocks (Sun et al., 2012).

Beine and Candelon (2007) suggested that macro-economic variables i.e., inflation differential among the associated countries have weak relation with stock market co-movement. These findings are also supported by (Canova and Nicolo, 2000). According to Flavin et al. (2002), many factors other than the macroeconomic variables like common borders and languages that lead towards higher levels of international equity co-movement.

According to Pretorius (2002), significant negative relationship of macroeconomic variables, i.e., GDP growth rate and inflation rate differential, is found with bilateral stock market co-movement among the participant countries. Baele and Inghelbrecht (2009) found that macroeconomic variables contribute little in explaining the bond and stock correlation as compared to liquidity

proxy variable. According to Mobarek and Fiorante (2014), lower growth rate differential among the countries lead to increase in bilateral stock market co-movement.

### 3. METHODOLOGY

#### 3.1 Data description

We use monthly data from January 2000 to December 2014 for our included variables. For measuring bilateral stock market co-movement, we use monthly index pricing for ten Asian stock markets. These stock markets include Pakistan, India, Bangladesh, China, Sri Lanka, Indonesia, Korea, Malaysia, Philippine and Thailand.

Pakistan is considered as a home country for variables estimations whereas others are considered as host countries. Returns for each country are then calculated by taking natural log of the difference between current and lagged equity prices. Among our independent variables, trading volume indicate the number of shares traded over an exchange for a given period. Market size differential refers to difference in stock market capitalization of two countries and is measured by dividing the product of shares traded and share prices by gross domestic product.

Foreign portfolio equity holdings refer towards direct purchases of stock shares (can also include American and global depository receipts) by foreign investors in local equity markets. These foreign portfolio equity holdings do not include direct investments by host countries in the local markets. Data for trading volume, market size differential and foreign portfolio equity holdings is collected on monthly frequency and sourced from World Bank database. Values of exchange and interest rates for sampled countries are extracted from International Financial Statistics (IFS) database on daily frequency and are converted to monthly values by taking average.

As the aim of this study is to explore the determinants of bilateral equity market co-movement and therefore main model of this study is appended below.

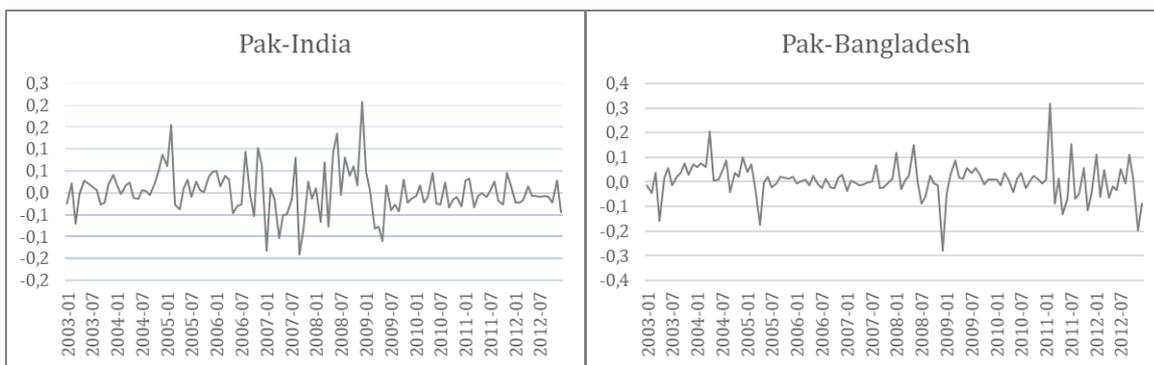
$$SMC_{ij,t} = \alpha + \beta_1 TV_{ij,t} + \beta_2 SD_{ij,t} + \beta_3 FPEH_{ij,t} + \beta_4 ED_{ij,t} + \beta_5 ID_{ij,t} + \epsilon_{ij,t} \quad (1)$$

Model 1 is the baseline model of our study and analyzes a panel of nine equity markets with Pakistani equity markets (as a home country). For equation 1, we start with the construction of our dependent variable i.e. bilateral stock market co-movement. This co-movement represent correlation of Pakistani equity market with other sampled equity markets and is constructed by using the time varying parameter model expression of which is presented below.

$$SMC_{ij,t} = \beta_0 + \beta_1 R_{i,t-1} + \beta_2 R_{j,t} \quad (2)$$

Where  $[[SMC]]_{(ij,t)}$  represent bilateral stock market co-movement between home (Pakistan) and host (other sampled Asian) equity markets. It is measured by taking daily return correlation values from 2000 to 2003 through rolling betas estimation procedure using multivariate regression. These rolling betas are then used to calculate bilateral monthly correlation values from 2003 to 2012.  $\beta_0$  present regression intercept,  $R_{(i,t-1)}$  is the lagged value of equity returns in home country i.e. Pakistan and  $R_{(j,t)}$  are host country equity returns.  $\beta_1$  and  $\beta_2$  represent coefficient of Pakistan lagged equity and host country equity returns respectively. Time trend of constructed bilateral co-movement of Pakistani equity market with other sampled stock markets is depicted in Figure 1.

**Figure 1 - Bilateral Return Co-movement**





Among independent variables (see equation 1), trading volume is based on the ratio of trading volume of host to home country, market size differential is calculated as a difference of market capitalization standardized per unit of gross domestic product of home and host countries, whereas foreign portfolio equity holding includes net inflows from equity securities other than those recorded as direct investment. It also includes share stocks depository receipts (American or global) and direct purchases of shares in local stock markets by foreign investors. Finally, interest and exchange rate differential between the home and selected host country is calculated as a difference in the monthly averaged values.

Table 1- Variable Description

Variable	Theoretical Justification	Calculation	Data base
Bilateral co-movement	Blackburn and Chidambaran (2011) Sheng (2012) Rockinger and Urga (2001) Kizys and Pierdzioch (2009)	$SMC_{ij,t} = \beta_0 + \beta_1 R_{i,t-1} + \beta_2 R_{j,t}$ $R_{i,t}$ is the return in the home country, $R_{i,t-1}$ is the lagged value of returns in the home country and $R_{j,t}$ is the value of the return in the country with which we are measuring co-movement	Econstat database
Trading volume	Gagnon and Karolyi (2003) Campbell, Grossman and Wang (1994) Llorente et al (2002) Gebka (2012) Campbell, Grossman and Wang (1994) Gagnon and Karoyli (2003) Sheng (2012) Chan and Hameed (2006)	Trading volume = Trading volume of country j (Home country)/Trading volume of country j (Host country)	Econstat database
Market size differential	Lucey and Zhang (2010) Chuhan (2003) Carrieri et al (2007) Pretorius (2002) Durnev et al (2003; 2004)	Market Size Diff. = Difference in the absolute values of Market Capitalization to GDP of country i and Market Capitalization to GDP of country j.	World Bank Development Indicators
Foreign portfolio equity holding	Coerdacier and Guibaud (2011) Lane and Ferretti (2003) Pretorius (2002)	Foreign portfolio equity holding of country j in other international equity markets	Econstat database
Exchange rate	Coerdacier and Guibaud (2011)	Difference in the FX rates w.r.t. US dollars between country i and country j.	International Financial Statistics
Interest rate	Ripley (1973) Backus, Kehoe, and Kydland (1992). Pretorius (2002) Quinn (2003) Campa and Fernandes (2006) Ragunathan et al. (1999)	Difference in interest rates between country i and country j.	World Bank Development Indicators

### 3.2 Data analysis and discussion

## 4. DATA ANALYSIS AND DISCUSSION

We start our analysis by presenting the descriptive statistics for selected equity markets returns in Table 2. Results highlight that maximum monthly returns are recorded by Indian equity market i.e. 24.7 percent whereas Pakistani market exhibit minimum equity return values (-44.9 percent). Chinese equity market exhibits maximum variance in monthly returns highlighting the associated risk. Table 2 also provides information on the normality of monthly returns by skewness and

kurtosis values. Except Thailand stock market, all equity indices are negatively skewed indicating the non-normality of monthly returns. Kurtosis values for Pakistan, Philippine, Indonesia and Thailand are very high also rejecting the hypothesis of normal distribution.

**Table 2- Monthly Stock Returns**

Statistic	Pakistan	India	Bangladesh	China	Sri Lanka	Indonesia	Korea	Malaysia	Philippines	Thailand
<b>Panel A: Stock Market Returns</b>										
Minimum	-0.449	-0.307	-0.048	-0.283	-0.176	-0.377	-0.263	-0.165	-0.275	-0.024
Maximum	0.202	0.247	0.054	0.243	0.212	0.183	0.127	0.127	0.139	0.178
Median	0.018	0.016	0.003	0.008	0.012	0.028	0.015	0.012	0.024	0.004
Mean	0.013	0.014	0.003	0.004	0.016	0.019	0.010	0.008	0.015	0.010
Variance	0.006	0.006	0.000	0.008	0.006	0.005	0.004	0.002	0.003	0.001
Std. dev.	0.080	0.077	0.013	0.087	0.076	0.069	0.062	0.040	0.058	0.027
Skewness	-1.811	-0.705	-0.257	-0.584	0.110	-1.682	-0.783	-0.544	-1.040	3.658
Kurtosis	8.464	2.300	3.874	1.292	0.186	7.794	2.055	2.674	4.058	16.139
JB Statistics	404.32*	0.293*	0.823*	0.503*	5.547*	1.800*	1.616*	0.961*	0.203*	3.398*
<b>Panel B: Stock Market Correlations</b>										
Pakistan	1	0.209*	-0.053	0.085	0.045	0.145	0.293*	0.155	0.169*	0.056
India		1	0.024	0.390*	0.221*	0.699*	0.670*	0.573*	0.597*	0.235*
Bangladesh			1	-0.062	0.170*	-0.024	0.025	-0.041	-0.020	0.111
China				1	0.072	0.374*	0.416*	0.498*	0.359*	0.004
Sri Lanka					1	0.310*	0.216*	0.324*	0.297*	0.059
Indonesia						1	0.674*	0.639*	0.650*	0.105
Korea							1	0.574*	0.475*	0.048
Malaysia								1	0.543*	0.130
Philippines									1	0.148
Thailand										1

Table 3 presents the descriptive statistics for our constructed variables. We can see that the average return co-movement of Pakistani equity market with other host countries has a low value of 0.1 percent suggesting high diversification benefits for local investors in making international investments. On average, variance of 6.5 percent is reported among bilateral equity co-movement between Pakistani and other included equity markets. As all variables are based either on the difference of values between the two countries or their ratio, we interpret these variables on relative basis to provide some meaningful analysis.

Difference in trading volume of Pakistan with host countries ranges from 0.020 units to a maximum of 271.26 units. Market size differential has negative values suggesting that the Pakistani equity market capitalization per unit of GDP is less than any other sample market size in a bilateral pair. Foreign portfolio equity holding has an average of almost 16 percent indicating the share that Pakistani equity market has in terms of the foreign investor's (the paired country) holdings. Exchange rate and interest rate differentials have mean differential values of 2.97 and 4.53 percent respectively. These moderate values suggest a mild difference in the macro-economic variables of the home and host countries included in pair.

**Table 3 - Descriptive Statistics**

Statistics	Bilateral Co-movement	Trading volume	Market size differential	Foreign Portfolio Equity Holding	Exchange rate	Interest rate
Mean	0.001	8.970	-31.847	15.967	2.970	4.530
Minimum	-0.340	0.020	-144.335	0.023	-8.790	-10.500
Maximum	0.451	271.259	39.135	24.481	12.470	14.500
Std. Dev.	0.065	25.787	42.410	9.366	2.835	4.814
Skewness	1.024	5.305	-0.728	-1.039	-0.427	-0.737
Kurtosis	8.822	35.828	-0.141	-0.761	2.426	0.336

To analyse unconditional correlation among included variables, we present results in Table 4. Correlation values ranging from mild to moderate levels are evident among our variables and therefore present no evidence of multicollinearity among them. Bilateral equity co-movement on average is significantly correlated with trading volume and foreign portfolio equity holding however, shows insignificance with market size differential and the interest rate and exchange rate variables. Among independent variables, market size differential has comparatively high negative correlation with interest rate differences between the pair of home (Pakistan) and host countries.

**Table 4 - Correlation values**

Variables	Co-movement	Trading volume	Market size differential	Foreign Portfolio Equity Holding	Exchange rate	Interest rate
Co-movement	1	0.075*	0.026	-0.085*	0.025	0.032
Trading Volume '000		1	-0.035	0.158*	0.140*	0.001
Mkt. Size Differential			1	-0.222*	-0.232*	-0.404*
Foreign Portfolio Equity Holding				1	-0.154*	0.236*
Exchange Rate					1	0.122*
Interest Rate						1

Note: \* represent values different from 0 with a significance level  $\alpha=0.05$

Table 5 presents panel unit root test results for all the variables. We employ IPS unit root test proposed by Im, Pesaran and Shin (2003) and ADF (Augmented Dickey Fuller) unit root test proposed by Dickey and Fuller (1979). The IPS test assumes the whole panel data as a combination of various time series regressions while considering the independent Dickey-Fuller test for each of the individual series.

This test not only allows for non-normality, heteroscedasticity and serial correlation test but also for heterogeneity of trends with lag coefficient and with an alternative hypothesis of no unit root in the panel. We present results of both, the ADF and IPS tests i) with constant only and ii) with constant and trend. We can see that all variables are stationary at first difference for both ADF and IPS tests thus exhibiting unit root properties in the presence of both only constant and with constant and trend.

**Table 5 - Panel Unit Root Analysis for Overall EFA Panel**

	<u>At level</u>				<u>At 1<sup>st</sup> difference</u>			
	<u>Drift and no trend</u>	<u>Prob.</u>	<u>Drift and trend</u>	<u>Prob.</u>	<u>Drift and no trend</u>	<u>Prob.</u>	<u>Drift and trend</u>	<u>Prob.</u>
<b>IPS Unit Root Test</b>								
Co-movement	-2.5357	0.5066	-1.3975	0.5111	-13.4270	0.0000	-12.5651	0.0000
Trading Volume	-3.7582	0.1001	-8.7642	0.1100	-19.5408	0.0000	-19.1104	0.0000
Mkt. Size Diff.	0.1818	0.5721	-0.7434	0.2286	-4.8079	0.0000	-3.4531	0.0003
FPEH	5.8854	1.0000	9.9324	1.0000	12.7544	0.0100	15.8348	0.0000
Exchange Rate	0.5473	0.7079	3.0540	0.9989	-8.2032	0.0000	-7.5216	0.0000
Interest Rate	1.0260	0.8475	4.5967	1.0000	7.2927	0.0000	-6.4402	0.0000
<b>ADF Unit Root Test</b>								
Co-movement	43.8966	0.0006	32.1261	0.0212	419.410	0.0000	312.911	0.0000
Trading Volume	38.2568	0.0036	419.869	0.0000	152.190	0.0000	146.269	0.0000
Mkt. Size Diff.	17.6331	0.4801	16.5275	0.5558	86.5917	0.0000	72.6399	0.0000
FPEH	5.2429	0.9821	3.1735	0.9987	83.4999	0.0000	72.0636	0.0000
Exchange Rate	13.9491	0.7324	6.7741	0.9919	419.411	0.0000	390.932	0.0000
Interest Rate	7.0774	0.9895	6.1234	0.9957	490.443	0.0000	499.940	0.0000

Table 6 present panel cointegration test results for our set of variables. We apply three different panel data tests i.e. Kao panel cointegration test (Kao, 1999), Pedroni panel cointegration test (Pedroni, 2004) and Johanson Fisher panel cointegration test (Fisher, 1995) to check relationship among our selected bilateral equity co-movement determinants and stock co-movements. We see the presence of cointegrating vectors among our variables across all the three tests. The results give us an indication to proceed in investigating the long and short run relationship of bilateral equity co-movements with trading volume, market size differential, foreign portfolio equity holdings, interest and exchange rate differentials.

**Table 6 - Panel Cointegration Tests**

<b>Tests</b>	<b>Statistics</b>	<b>P values</b>
<b>Kao Panel cointegration</b>		
ADF t-Statistics	-3.6976	0.0001
<b>Pedroni Panel cointegration</b>		
Panel v-Statistics	0.2002	0.4207
Panel rho-Statistics	-1.6146	0.0532
Panel PP-Statistics	-2.7305	0.0032
Panel ADF-Statistics	-1.1767	0.1197
Group rho-Statistics	-0.4093	0.3411
Group PP-Statistics	-2.3493	0.0094
Group ADF-Statistics	-0.4987	0.3090
<b>Johansen Fisher Panel Co-integration</b>		
Trace Statistics		
None	260.1061	0.0000
At most 1	98.7588	0.0000
At most 2	79.3447	0.0000
At most 3	28.5961	0.0535
At most 4	15.2962	0.6415
At most 5	18.8896	0.3987
Maximum Eigen statistics		
None		

At most 1	183.7310	0.0000
At most 2	84.4241	0.0000
At most 3	80.9576	0.0000
At most 4	21.6559	0.2476
At most 5	11.3926	0.8770

We report long term relationship of trading volume, market size differential, foreign portfolio equity holding, interest rate and exchange rate differential with bilateral equity co-movement of Pakistani stocks with other selected Asian equity markets. We apply fully modified OLS and dynamic OLS to capture these long-term effects. Results of fully modified OLS test suggest that all the included variables have significant effect on bilateral equity market co-movement however except market size differential, all the variables have positive effect on bilateral equity co-movement. Although the magnitude of relationship is not strong, still the direction of relationship can have influential impact.

According to Erb et al (1994), strong link exists among the stock market co-movement and macroeconomic variables whereas many researchers like Verma and Ozuna (2005) and Kizys and Pierdzioch (2006) reported a weak relationship among various macroeconomic variables and international co-movement of returns. International investors need not to pay attention on the foreign ownership of equity rather composition of the stockholding of firm's shareholders is of utmost importance (Bartram et al 2009) and thereby confirming the results of our study regarding foreign portfolio equity holding. Lucey and Zhang (2010) and Moberak et al (2014) also suggested that bilateral trade size should be positively related to the stock market co-movement because with strong relationship in bilateral trade, interdependence in the economies and associated markets is expected among the countries (Walti 2011).

Market size differential has negative relationship with the bilateral equity co-movement suggesting that a 10 percent change in market size differential among the associated bilateral equity markets causes 0.15 percent change in the bilateral equity co-movement of Pakistani equity market with its associated pair. The results of dynamic OLS confirm the findings of fully modified OLS except for trading volume and exchange rate differential variables. Both these variables are insignificant in dynamic regression framework however rest of the results is similar. Results for market size differential in dynamic OLS are same to the findings of fully modified OLS test results.

Table 7 - FMOLS/DOLS Test Results

Bilateral Equity co-movement	Coefficient	P values	t Statistics
<b>FMOLS</b>			
Trading Volume	0.0006* (0.0011)	0.001	1.9667
Mkt. Size Differential	-0.0015* (0.0010)	0.020	-1.8561
Interest Rate	0.0059** (0.0065)	0.021	1.8944
Foreign Portfolio Equity Holding	0.0026* (0.0258)	0.002	2.1014
Exchange Rate	0.0000* (0.0001)	0.001	2.1875
<b>DOLS</b>			
Trading Volume '000	0.0007 (0.0011)	0.102	0.6378
Mkt. Size Differential	-0.0017* (0.0011)	0.001	-2.5090
Interest Rate	0.0212* (0.0078)	0.000	2.7298
Foreign Portfolio Equity Holding	-0.0175* (.0308)	0.000	-2.5696
Exchange Rate	0.0000 (0.0001)	0.091	1.6746

After reporting long run relationship of trading volume, market size differential, foreign portfolio equity holding, interest rate and exchange rate differential on bilateral equity co-movement of Pakistani stocks with other selected Asian equity markets, we present results for short term relationship of these equity determinants with bilateral co-movement in Table 8. We selected lags for each variable up to 2nd order according to the Akaike lag order selection criteria. Among all variables, trading volume and exchange rates differentials are significant in inducing short run changes in bilateral equity market co-movement of Pakistan with other stock markets.

Our results are in accordance with Bertrand and Zitouna (2006) as he suggested that trade liberalization tends to increase the level of correlation among the trading partners and Baele (2009) that increase in trade integration level results in the increasing exposure level of equity to the global equity markets. Our results also confirm the findings of Beine and Candelon (2007) who documented positive effect on stock market co-movement due to trade intensity.

According to Vermeulen (2010), increase in the level of trade integration results in increasing level of co-movement. Walti and Benetrix (2008) also reported the increasing level of stock market co-movement in European countries due to rise in the level of financial integration and trade. Market size differential, foreign portfolio equity holding and interest rate differential are significant in long run however are unable to produce any variation in short run. Error correction term in Table 8 is significant and its value suggests that the short-term relationship reverts towards the long run in due course.

Table 8 - VECM Results

	Statistics		
	Coefficient	Standard Error	t-value
$\Delta$ Trading volume (-1)	-0.0001	0.0005	-2.2483
$\Delta$ Trading volume (-2)	-0.0009	0.0040	-2.3060
$\Delta$ Market size (-1)	0.0010	0.0064	0.1503
$\Delta$ Market size (-2)	-0.0034	0.0064	-0.5316
$\Delta$ Foreign Portfolio Equity Holding (-1)	-0.0195	0.0580	-0.3360
$\Delta$ Foreign Portfolio Equity Holding (-2)	0.0112	0.0346	0.3231
$\Delta$ Exchange Rate (-1)	0.0010	0.0003	3.7729
$\Delta$ Exchange Rate (-2)	-0.0010	0.0026	-3.7295
$\Delta$ Interest Rate (-1)	-0.0122	0.0088	-1.3806
$\Delta$ Interest Rate (-2)	0.0024	0.0086	0.2795
$\Delta$ Intercept	0.0005	0.0058	0.0770
$\Delta$ ECT	-0.1694	0.0123	2.8652

Table 9 presents panel granger causality test results. We can see that bidirectional causality exist between i) exchange and interest rate differentials and foreign portfolio equity holding, ii) foreign portfolio equity holdings with market size differential and bilateral equity co-movement and iii) between market size and interest rate differentials. Unidirectional causality runs from i) bilateral equity market co-movement to trading volume, ii) interest rate differential to bilateral equity co-movement and iii) from exchange rate differentials to market size differential and bilateral equity co-movement. Our results therefore highlight the relationship not only between bilateral equity co-movement and its determinants but among the determinants of such co-movements as well.

Table 9 - Panel Granger Causality

Direction of Causality	EFA Panel			Direction of Causality	Frontier Panel		
	$W_{NT}^{HNC}$	$Z_{NT}^{HNC}$	P-Value		$W_{NT}^{HNC}$	$Z_{NT}^{HNC}$	P-Value
FPEH→ER	27.5041	34.8279	0.0000	MC→FPEH	12.5809	14.3837	0.0000
ER→FPEH	14.2375	16.6532	0.0000	FPEH→MC	41.4756	53.9682	0.0000
TV→Comovement	2.9518	1.3238	0.1856	Comovement→FPEH	4.0320	2.6721	0.0075
Comovement→TV	4.3657	3.3687	0.0008	FPEH→Comovement	6.5484	6.1195	0.0000
MC→ER	2.6258	0.8535	0.3934	TV→FPEH	1.5617	-0.7128	0.4760
ER→MC	0.5689	-2.1231	0.0337	FPEH→TV	2.6127	0.7257	0.4680
Comovement→ER	1.6969	-0.4908	0.6235	MC→IR	9.6581	11.0302	0.0000
ER→Comovement	9.0589	10.1631	0.0000	IR→MC	3.5499	2.1908	0.0285
TV→ER	0.5778	-2.1100	0.0349	Comovement→IR	2.9151	1.2721	0.2033
ER→TV	2.1872	0.2179	0.8275	IR→Comovement	8.1698	8.8764	0.0000
IR→FPEH	17.8295	21.5740	0.0000	TV→IR	1.1942	-1.2183	0.2231
FPEH→IR	24.1317	30.2077	0.0000	IR→TV	9.6729	11.0450	0.0000
Comovement→MC	1.8481	-0.2720	0.7856	TV→MC	2.2266	0.2749	0.7834
MC→Comovement	3.0461	1.4616	0.1438	MC→TV	5.9781	5.7009	0.0000

## 5. CONCLUSION

International portfolio diversification depends on the level of correlation among equity indices however determinants of such co-movements need to be identified. We select trading volume, market size differential, foreign portfolio equity holding, interest and exchange rate differential as determinants of bilateral equity market co-movement of Pakistani equity market with other Asian emerging and frontier markets over the monthly span 2000-2014.

Our results indicate the presence of long term co-integrating relationship of between bilateral equity market co-movement. However, in short-run only bilateral trading volume and exchange rate differential between the two countries have significant impact on bilateral equity co-movement. These findings have implications for international individual as well as institutional investors.

Understanding these relationships between bilateral equity market co-movement and its determinants can help foreign investors to gain diversification benefits while investing in Pakistani equity market. Similarly, this study also has implications for local investors in Pakistan. They can diversify their equity portfolios by including foreign keeping in view the associated bilateral co-movement, its determinants and their underlying relationship.

## REFERENCES

- Aggarwal, R., Lucey, B., & Muckley, C. (2010). Dynamics of equity market integration in Europe: impact of political economy events. *JCMS: Journal of Common Market Studies*, 48(3), 641-660.
- Allen, F., & Gale, D. (2004). Competition and financial stability. *Journal of Money, Credit, and Banking*, 36(3), 453-480.
- Arouri, M. E. H., Jouini, J., & Nguyen, D. K. (2012). On the impacts of oil price fluctuations on European equity markets: Volatility spillover and hedging effectiveness. *Energy Economics*, 34(2), 611-617.
- Backus, D., Kehoe, P., & Kydland, F. (1992). International Real Business Cycles. *Journal of Political Economy*, 100, 745-775.
- Baele, L., & Inghelbrecht, K. (2009). Time-varying integration and international diversification strategies. *Journal of Empirical Finance*, 16, 368-387.
- Baele, L., Ferrando, A., Hördahl, P., Krylova, E., & Monnet, C. (2004). Measuring European financial integration. *Oxford Review of Economic Policy*, 20(4), 509-530.
- Barberis, N., Shleifer, A., & Wurgler, J. (2005). Comovement. *Journal of Financial Economics*, 75(2), 283-317.
- Bartram, S.M., G.W. Brown and B. Minton 2009. "Resolving the Exposure Puzzle: The Many Facets of Foreign Exchange Exposure." *Journal of Financial Economics*, forth- coming.
- Beine, M., & Candelon, B. (2007). Liberalization and stock market co-movements between emerging markets (No. 2131). *CESifo Working Paper*.
- Beine, M., & Candelon, B. (2011). Liberalisation and stock market co-movement between emerging economies. *Quantitative Finance*, 11(2), 299-312.
- Bekaert, G., & Harvey, C. R. (1995). Time-varying world market integration. *The Journal of Finance*, 50(2), 403-444.
- Bekaert, G., Ehrmann, M., Fratzscher, M., & Mehl, A. (2014). The global crisis and equity market contagion. *The Journal of Finance*, 69(6), 2597-2649.
- Bénétrix, A. S., & Wälti, S. (2008). Indicators of regional financial integration.
- Bertrand, O., & Zitouna, H. (2006). Trade liberalization and industrial restructuring: the role of cross-border mergers and acquisitions. *Journal of Economics & Management Strategy*, 15(2), 479-515.
- Blackburn, D. W., & Chidambaran, N.K. (2011). Is World Stock Market Co- Movement Changing? *Discussion Paper Series*.
- Calvo, G. A., & Coricelli, F. (1994). Credit market imperfections and output response in previously centrally planned economies. *Building Sound Finance in Emerging Market Economies*, 257-94.

- Campa, J. M., & Fernandes, N. (2006). Sources of gains from international portfolio diversification. *Journal of Empirical Finance*, 13, 417-443.
- Campbell, J. Y., & Hamao, Y. (1992). Predictable stock returns in the United States and Japan: A study of long-term capital market integration. *The Journal of Finance*, 47(1), 43-69.
- Campbell, J. Y., Grossman, S. J., & Wang, J. (1993). Trading volume and serial correlation in stock returns. *Quarterly Journal of Economics*, 108, 905-939.
- Canova, F., & De Nicolo, G. (2002). Monetary disturbances matter for business fluctuations in the G-7. *Journal of Monetary Economics*, 49(6), 1131-1159.
- Carrieri, F., Errunza, V., & Hogan, K. (2007). Characterizing world market integration through time. *Journal of Financial and Quantitative Analysis*, 42, 915-940.
- Chan, K., & Hameed, A. (2006). Stock Price Synchronicity and Analyst Coverage in Emerging Markets. *Journal of Financial Economics*, 80, 115-147.
- Chi, J., Li, K., & Young, M. (2006). Financial integration in East Asian equity markets. *Pacific Economic Review*, 11(4), 513-526.
- Choe, K. I., Choi, P., Nam, K., & Vahid, F. (2012). Testing financial contagion on heteroskedastic asset returns in time-varying conditional correlation. *Pacific-Basin Finance Journal*, 20(2), 271-291.
- Christoffersen, P., Errunza, V., Jacobs, K., & Langlois, H. (2012). Is the potential for international diversification disappearing? A dynamic copula approach. *Review of Financial Studies*, 25(12), 3711-3751.
- Chuhan, P. (2003). Are institutional investors an important source of portfolio investment in emerging markets? Policy Research Working Paper 1243. Debt and International Finance Division, World Bank.
- Coerdacier, N., & Guibaud, S. (2011). International portfolio diversification is better than you think. *Journal of international money and finance*, 30, 289-308.
- Dellas, H., & Hess, M. (2005). Financial development and stock returns: A cross-country analysis. *Journal of International Money and Finance*, 24(6), 891-912.
- Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American statistical association*, 74(366a), 427-431.
- Durnev, A., Morck, R., & Yeung, B. (2004). Value-enhancing capital budgeting and firm-specific stock return variation. *Journal of Finance*, 59, 65-105.
- Durnev, A., Morck, R., Yeung, B., & Zarowin, P. (2003). Does greater firm-specific return Variation mean more or less informed stock pricing? *Journal of Accounting Research*, 41, 797-836.
- Erb, C. B., Harvey, C. R., & Viskanta, T. E. (1994). Forecasting international equity correlations. *Financial analysts journal*, 50(6), 32-45.
- Erb, C. B., Harvey, C. R., & Viskanta, T. E. (1996). Expected returns and volatility in 135 countries. *The Journal of Portfolio Management*, 22(3), 46-58.
- Erbaykal, E., & Karaca, O. (2008). Is Turkey's foreign deficit sustainable? Cointegration relationship between exports and imports. *International Research Journal of Finance and Economics*, 14(3), 177-181.
- Fisher, N. I. (1995). Statistical analysis of circular data. Cambridge University Press.
- Flavin, M., & Yamashita, T. (2002). Owner-occupied housing and the composition of the household portfolio. *The American Economic Review*, 92(1), 345-362.
- Flavin, T. J., Hurley, M. J., & Rousseau, F. (2002). Explaining stock market correlation: A gravity model approach. *The Manchester School*, 70(S1), 87-106.
- Forbes, K. J., & Chinn, M. D. (2004). A decomposition of global linkages in financial markets over time. *Review of economics and statistics*, 86(3), 705-722.

- Forbes, K. J., & Rigobon, R. (2002). No contagion, only interdependence: measuring stock market comovements. *The Journal of Finance*, 57(5), 2223-2261.
- Gagnon, L., & Karolyi, G.A. (2003). Information, Trading Volume and International Stock Market Co-movements. *International Finance Review*, 4, 347-377.
- Gebka, B. T. (2012). The dynamic relation between returns, trading volume, and volatility: lessons from spillovers between Asia and the United States. *Bulletin of Economic Research*, 64(1), 65-90.
- Grubel, H. G. (1968). Internationally diversified portfolios: welfare gains and capital flows. *The American Economic Review*, 58(5), 1299-1314.
- Gupta, R., & Guidi, F. (2012). Cointegration relationship and time varying co-movements among Indian and Asian developed stock markets. *International Review of Financial Analysis*, 21, 10-22.
- Hardouvelis, G. A., Malliaropulos, D., & Priestley, R. (2006). EMU and European stock market integration. *The Journal of Business*, 79(1), 365-392.
- Huang, B. N., Yang, C. W., & Hu, J. W. S. (2000). Causality and cointegration of stock markets among the United States, Japan and the South China Growth Triangle. *International Review of Financial Analysis*, 9(3), 281-297.
- Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of econometrics*, 115(1), 53-74.
- Jeon, B. N., & Chiang, T. C. (1991). A system of stock prices in world stock exchanges: common stochastic trends for 1975-1990. *Journal of Economics and Business*, 43(4), 329-338.
- Kallberg, J., & Pasquariello, P. (2008). Time-series and cross-sectional excess comovement in stock indexes. *Journal of empirical finance*, 15(3), 481-502.
- Kao, C. (1999). Spurious regression and residual-based tests for cointegration in panel data. *Journal of econometrics*, 90(1), 1-44.
- Kearney, C., & Poti, V. (2006). Correlation dynamics in European equity markets. *Research in International Business and Finance*, 20(3), 305-321.
- Kenourgios, D., & Padhi, P. (2012). Emerging markets and financial crises: regional, global or isolated shocks? *Journal of Multinational Financial Management*, 22(1), 24-38.
- King, M. A., & Wadhvani, S. (1990). Transmission of volatility between stock markets. *Review of Financial studies*, 3(1), 5-33.
- Kizys, R., & Pierdzioch, C. (2009). Changes in the international co-movement of stock returns and asymmetric macroeconomic shocks. *Journal of International Financial Markets, Institutions and Money*, 19, 289-305.
- Kyle, A. S., & Xiong, W. (2001). Contagion as a wealth effect. *The Journal of Finance*, 56(4), 1401-1440.
- Lane, P.R., & Ferretti, G.M.M. (2003). International Financial Integration. IMF Working Papers, 03/86.
- Lin, W. L., Engle, R. F., & Ito, T. (1994). Do bulls and bears move across borders? International transmission of stock returns and volatility. *Review of financial studies*, 7(3), 507-538.
- Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The review of economics and statistics*, 13-37.
- Liu, X. F., & Chi, K. T. (2012). Dynamics of Network of Global Stock Markets. *Accounting and Finance Research*, 1(2), 1.
- Llorente, G., Michaely, R., Saar, G., Wang, J. (2002). Dynamic Volume-Return Relation of Individual Stocks. *The Review of Financial Studies*, 15(4), 1005-1047.
- Longin, F., & Solnik, B. (1995). Is the correlation in international equity returns constant: 1960-1990? *Journal of international money and finance*, 14(1), 3-26.

- Lucey, B.M., & Zhang, Q. (2010). Does cultural distance matter in international stock market co-movement? Evidence from emerging economies around the world. *Emerging Markets Review*, 11, 62–78.
- Markowitz, H. (1952). Portfolio selection. *The journal of finance*, 7(1), 77-91.
- Mobarek, A., & Fiorante, A. (2014). The prospects of BRIC countries: Testing weak-form market efficiency. *Research in international Business and Finance*, 30, 217-232.
- Mobarek, A., & Fiorante, A. (2014). The prospects of BRIC countries: Testing weak-form market efficiency. *Research in International Business and Finance*, 30, 217-232.
- Mukherjee, P., & Bose, S. (2008). Does the stock market in india move with Asia? A multivariate cointegration-vector autoregression approach. *Emerging Markets Finance and Trade*, 44(5), 5-22.
- Narayan, S., & Rehman, M. U. (2017). Diversification opportunities between emerging and frontier Asian (EFA) and developed stock markets. *Finance Research Letters*, 23, 223-232.
- Panton, D. B., Lessig, V. P., & Joy, O. M. (1976). Comovement of international equity markets: a taxonomic approach. *Journal of Financial and Quantitative Analysis*, 11(03), 415-432.
- Pedroni, P. (2004). Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric theory*, 20(03), 597-625.
- Pretorius, E. (2002). Economic determinants of emerging stock market interdependence. *Emerging Markets Review*, 3, 84-105.
- Quinn, D., & Voth, H.J. (2003). Free Flows, Limited Diversification: Openness and the Fall and Rise of Stock Market Correlations. *NBER International Seminar on Macroeconomics*, 4, 7-39.
- Ragunathan, V., Faff, R.W., & Brooks, R.D. (1999). Correlations, business cycles and integration. *Journal of International Financial Markets, Institutions and Money*, 9, 75–95.
- Rehman, M. U. (2016). Financial Contagion in EFA Markets in Crisis Periods: A Multivariate GARCH Dynamic Conditional Correlation Framework.
- Rehman, M. U., & Shah, S. M. A. (2016). Determinants of Return's Co-Movement for Effective Portfolio Diversification Among Regional Stock Markets. *Revista Evidenciação Contábil & Finanças*, 4(1), 84-96.
- Rehman, M. U., & Shah, S. M. A. (2016). Dynamics of effective portfolio diversification among EFA markets: a heterogeneous panel analysis. *African Journal of Accounting, Auditing and Finance*, 5(3), 193-206.
- Rehman, M. U., & Shahzad, S. J. H. (2017). Heterogeneous Panel Analysis among Equity Returns for Portfolio Diversification: Evidence from Emerging and Frontier Asian Equity Markets. *South Asian Journal of Management Sciences (SAJMS)*, Iqra University, 11(2), 109-123.
- Rehman, M. U., Shahzad, S. J. H., Kanwal, M., & Ali, S. (2017). Relationship Between Economic Growth, Financial Development and Worker's Remittances in South Asia. *Revista Evidenciação Contábil & Finanças*, 6(1), 132-144.
- Ripley, D. M. (1973). Systematic elements in the linkage of national stock market indices, *Review of Economics and Statistics*, 55, 356–361.
- Rockinger, M., & Urga, G. (2001). A time-varying parameter model to test for predictability and integration in the stock markets of transition economies. *Journal of Business Economics and Statistics*, 19, 73–84.
- Shahzad, S. J. H., Kanwal, M., Ahmed, T., & Ur Rehman, M. (2016). Relationship between developed, European and South Asian stock markets: a multivariate analysis. *South Asian Journal of Global Business Research*, 5(3), 385-402
- Sheng, C.S., (2012). Revisiting the empirical linkages between stock returns and trading volume. *Journal of Banking & Finance*, 36(6), 1781-1788.

- Sohail, A., Rehman, M. U., & Javid, A. Y. (2016). Stock Market Reactions on Returns and Trading Volume: The Impact of the Global Financial Crisis. *Revista Evidenciação Contábil & Finanças*, 5(1), 132-151.
- Soukup, G. A., & Breaker, R. R. (1999). Relationship between internucleotide linkage geometry and the stability of RNA. *Rna*, 5(10), 1308-1325.
- Sun, Z., Wang, A., & Zheng, L. (2012). The road less traveled: Strategy distinctiveness and hedge fund performance. *Review of Financial Studies*, 25(1), 96-143.
- Uygur, U., & Taş, O. (2014). The impacts of investor sentiment on different economic sectors: Evidence from Istanbul Stock Exchange. *Borsa Istanbul Review*, 14(4), 236-241.
- Verma, R., & Ozuna, T. (2005). Are emerging equity markets responsive to cross-country macroeconomic movements? *Evidence from Latin America. Journal of International Financial Markets, Institutions and Money*, 15, 73-87.
- Vermeulen, R. (2010). Dynamic International Portfolio Adjustment: Rational Investors and the Home Bias, Mimeo.
- Walti, S. (2011). Stock market synchronization and monetary integration. *Journal of International Money and Finance*, 30 (1), 96-110
- Wang, G. J., Xie, C., Chen, S., Yang, J. J., & Yang, M. Y. (2013). Random matrix theory analysis of cross-correlations in the US stock market: Evidence from Pearson's correlation coefficient and detrended cross-correlation coefficient. *Physica A: statistical mechanics and its applications*, 392(17), 3715-3730.
- Wong, W. K., Penm, J., Terrell, R. D., & Ching, K. Y. (2004). The relationship between stock markets of major developed countries and Asian emerging markets. *Journal of Applied Mathematics & Decision Sciences*, 8(4), 201-218.
- Zhang, B., & Li, X. M. (2014). Has there been any change in the comovement between the Chinese and US stock markets? *International Review of Economics & Finance*, 29, 525-536.